FOREST PEST MANAGEMENT
Pacific Southwest Region

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A BIOLOGICAL EVALUATION OF DARDANELLE CAMPGROUND, SUMMIT RANGER DISTRICT, STANISLAUS NATIONAL FOREST

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ABSTRACT

The Dardanelle Campground on the Summit Ranger District was evaluated for pest problems which may affect management objectives for the site. The major pests noted were western dwarf mistletoe on Jeffrey pine and annosus root disease on white fir. Management alternatives discussed for the site include no change in current management direction, dwarf mistletoe management, annosus root disease management, tree hazard management, and gopher control.

INTRODUCTION

In response to a request from the Stanislaus National Forest, a biological evaluation of Dardanelle Campground on the Summit Ranger District was conducted during the week of June 17-21, 1985. The campground is proposed for re-design as funding becomes available. Design proposals are in response to decisions made in the Dardanelle Campground Environmental Assessment of May 1980. The objective of the re-design is to protect existing vegetation and to enhance the natural appearance of the site by the addition of traffic controls and planting. The objectives of the biological evaluation were to identify existing and potential pest situations, to provide information on the expected future condition of the site, and to present pest management alternatives for consideration by the Forest and the District during the implementation of the Final Site Plan for the campground.

OBSERVATIONS

The 25 unit campground, located adjacent to Eagle Creek at 5600 feet elevation, is within a mixed conifer forest consisting of an overstory of primarily Jeffrey pine. Some white fir are intermixed. Understory vegetation consists of incense-cedar and white fir. Cottonwoods occur along the creek. Shrub and ground cover is generally sparse, but includes white thorn, manzanita, and unidentified shrubs.

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A diagramatic map of the proposed site plan for the campground with approximate locations of the insect and disease pests observed is in the Appendix (Figure 1). Site specific notes taken during the evaluation accompany the map. Pests noted included western dwarf mistletoe (Arceuthobium campylopodum) generally scattered throughout the area on Jeffrey pines; annosus root disease (Fomes annosus) associated with white fir in one location; and fir engraver (Scolytus ventralis) and roundheaded borers (Tetropium spp.) associated with dying white firs. Potentially hazardous trees, primarily white firs, occurred throughout. Gopher activity was present at the western end of the campground. Numerous white fir stumps, indicating past tree mortality, were present in the same area. Minor diseases noted included incense-cedar rust (Gymnosporangium libocedri) and yellow witches broom (Melampsorella caryophyllacearum) on white fir. Lack of well-defined roads, parking areas and camp spurs are contributing to soil compaction from recreationists and vehicles.

MANAGEMENT ALTERNATIVES

1. No Change in Current Management Direction. Western dwarf mistletoe will intensify in Jeffrey pines already infected and spread to adjacent understory pines to perpetuate the disease. As the dwarf mistletoe-infected pines in the overstory die, the more shade-tolerant white firs and incense-cedars in the understory will be released. As a consequence, and as they grow larger, the white fir will pose a greater hazard potential because of the increased decay susceptibility of white fir and the hazard of root infection by F. annosus. Additional annosus root disease centers may develop as dead and hazardous white firs are removed. White firs stressed by annosus root disease will be susceptible to attack by the fir engraver.

Implementation of the Site Plan, which includes utilization of natural barriers, placement of artifical barriers, and planting of native plants, will reduce existing soil compaction and site deterioration. However, any Jeffrey pines planted near a source of overstory dwarf mistletoe will likely become infected. Height growth, as well as the future recreation value of the trees, will be limited. Plantings in areas of gopher activity will probably be killed or in other ways damaged unless control measures are implemented.

2. Dwarf Mistletoe Management. Dwarf mistletoes can be controlled by eradication or by suppression. Eradication of dwarf mistletoe, which would involve removing infected Jeffrey pines, is not viable in most portions of Dardanelle Campground because of its widespread occurrence and because the existing sparse overstory of Jeffrey pines would be depleted.

Suppression of dwarf mistletoe involves minimizing the effects of the disease while tolerating a low level of infection. Various tactics are available for reducing the impact of dwarf misteltoe in recreation sites.

a. Remove infected overstory trees to protect regeneration. To prevent infection of understory pines, infected overstory trees can be removed to eliminate the source of inoculum. Infected understory trees can then be removed or pruned to remove dwarf mistletoe infections. Pruning of infected branches, where infections are in the lower crown and the overstory source of dwarf mistletoe seeds has been removed, may lessen some impacts and permit more rapid height growth free of infection. This alternative would be feasible in

portions of the campground where overstory trees can be removed without adversely affecting the visual quality of the site. Removal of infected overstory trees should be considered in areas where Jeffrey pines will be planted.

b. Broom pruning. In areas of the campground where dwarf mistletoe eradication is not possible and removal of the overstory source of infection cannot be accomplished or tolerated, then pruning of witches' brooms can be beneficial. The objective of broom pruning is to lengthen the expected life span of selected trees that have special value to the campground. This type of pruning is not recommended for heavily infected (Hawksworth dwarf mistletoe ratings of 5 and 6) trees. In any pruning operation, no more than 50% of the crown should be removed and at least 30% live crown ratio should exist after pruning.

c. Encourage tree species diversity. A mix of non-susceptible species in infested stands provides a barrier to spread of dwarf mistletoe. An increase of the present species mix at Dardanelle would reduce future impacts of western dwarf mistletoe. The planting of incense-cedar, as called for in the Site Plan, would be beneficial. Planting of other nonhosts suitable to the site, including hardwoods, would also be beneficial.

3. Annosus Root Disease Management. The most effective control for annosus root disease is prevention. The probability of the formation of new centers, and the resulting adverse effects of the disease, can be reduced by the application of borax (sodium tetraborate decahydrate, EPA Reg. 1624-94) to all freshly-cut conifer stumps in the campground (see FSM 3205, 2331.33, R-5 Supplement No. 90). Basal wounds on true fir are also entry courts for F. annosus. Wounding of residual white firs when removing dwarf-mistletoe infected overstory trees or when removing trees for other reasons should be avoided to prevent subsequent decay. Wounded trees should be considered for removal.

The one annosus center located at Dardanelle was apparently restricted to white fir. Because centers established in white fir are a threat only to true fir, pines, incense-cedar, and hardwoods can be planted in and around the center with little or no hazard from F. annosus.

Thinning active annosus centers may increase the tolerance of white fir to infection by increasing their rate of root regeneration and replacement, and will minimize opportunites for root contact and subsequent spread. In addition, thinning dense aggregations of true fir will alleviate overstocking as a predisposing factor to fir engraver attack.

4. Tree Hazard Management. Potentially hazardous trees (pines severely infected with dwarf mistletoe, pines with dead dwarf mistletoe brooms, and white firs with basal wounds, dead tops, and those infected with annosus root disease) are present in the campground, and additional hazardous trees will likely develop during paving of roads and other activities during implementation of the Site Plan. Removal of trees rated as high hazard should be considered during construction phases. This would be less costly than removing these trees after new facilities are in place. Attempts to minimize development of hazardous trees during site improvement phases should be made. The area should be rated again for tree hazard after site improvements are made, and a procedure for a formal inspection on a regular basis to identify hazardous trees implemented.

5. Control Gophers. Attempts at regenerating the area in the western portion of the campground where gopher activity was noted may be unsuccessful without gopher control. The need for control efforts depends on management objectives as well as on pocket gopher activity levels determined by mound surveys (see Animal Damage Control Handbook, FSH 2609.22). Reducing or preventing gopher damage can be accomplished by 1) direct reduction in numbers by trapping and baiting, 2) preventing population increases by controlling grasses and forbs, and by 3) the use of physical barriers such as "Vexar" tubing around shoots and roots of seedlings.

PEST BIOLOGIES

Western Dwarf Mistletoe

The dwarf mistletoes are serious forest diseases in much of the western United States, causing extensive growth loss and predisposing conifers to attack by bark beetles and other pathogens. Arceuthobium campylopodum, or western dwarf mistletoe, principally infects ponderosa and Jeffrey pines. Coulter and knobcone pines may be attacked when they grow in association with the principal hosts, while sugar pine and Douglas-fir are not susceptible.

Dwarf mistletoes are flowering plants that require a living host, from which they obtain most of their nutrients and all of their minerals and water. They spread by means of sticky seeds that are forcibly discharged from the plants in the fall, and adhere to whatever they contact. If a seed lands on a host needle or twig, it remains there over winter; the following spring it germinates, and the radicle penetrates the host. The parasite develops a root-like endophytic system in the inner bark and outer sapwood, and produces aerial shoots within 2-4 years after initial infection. Another 2-4 years elapse before seed are produced.

The spread of dwarf mistletoe is limited to the distance the seed travel, which from overstory to understory is usually 20-60 feet; with the aid of wind, seed may be carried as far as 100 feet. A rule of thumb is that dwarf mistletoes can spread a horizontal distance equal to the height of the plants in an infected tree. Because of various limits to spread and the long life cycle, the actual spread rate through an even-aged stand is usually 1-2 feet per year. Vertical spread through a tree crown is about 3-4 inches per year.

The impact of the dwarf mistletoes is influenced significantly by host vigor; slow-growing trees succumb more rapidly than thrifty ones, and dense, stagnated stands are especially vulnerable. A. campylopodum often causes witches' brooms (abnormal proliferations of twigs that appear as clustered masses of foliage); these are usually most pronounced in the lower branches, and eventually lead to the decline of the upper crown.

Annosus Root Disease of True Fir

Fomes annosus is a fungus that attacks a wide variety of woody plants. All western conifer species are susceptible. Madrone (Arbutus menziesii), and a few brush species (Arctostaphylos spp. and Artemisia tridenta) are occasional hosts. Other hardwood species are apparently not infected. The disease has

been reported on all the National Forests in California, with incidence particularly high on true fir in northern California campgrounds. Incidence is somewhat higher in older, larger fir stands and in stands with high basal areas (over about 330 square feet/acre).

During periods favorable to the fungus, fruiting bodies (conks) form in decayed stumps, under the bark of dead trees, or under the duff at the root collar. New infection centers begin by aerial spread of spores produced by the conks and subsequent colonization of freshly cut stump surfaces or wounds on living trees. The fungus then spreads through root contacts into the root systems of adjacent live true fir. Local spread of the fungus from a stump typically results in the formation of a disease center, with dead trees in the center and fading trees on the margin. These centers usually continue to enlarge until they reach natural barriers such as stand openings or non-susceptible plants.

In pines, F. annosus grows through root cambial tissue to the root crown where it girdles and kills the trees. In less resinous species such as true firs, the fungus sometimes kills trees, but more frequently it is confined to the heartwood and inner sapwood of the larger roots where it causes a chronic butt and root decay and growth loss. Thus, while infection in true fir usually does not kill the host, it does affect its growth and thriftiness. Losses in true fir from F. annosus are mainly the result of windthrow resulting from root decay, and reduced root systems which predispose trees to attack and eventual death by the fir engraver beetle. Field observations suggest that vigorous young firs are usually able to regenerate root tissues faster than they are lost to the root disease. But when true firs slow in growth because of stand and/or site conditions, root development decreases to where there is a net loss in roots and the trees slowly decline due to the gradual loss of their root systems. This decline may take 10 to 20 years before tree death occurs.

In general, infections will cross from roots of pine to roots of true fir; however, rarely is the fungus observed to cross from true fir to pine. At higher elevations where pine and true fir are intermixed, F. annosus is commonly found only on true fir and mortality rarely includes both species within an infection center.

Pocket Gopher

The pocket gopher, Thomomys bottae, is a rodent in the family Geomyidae. They spend most of their life in an extensive tunnel system. The surface openings to their tunnel system are kept well plugged except while burrowing, gathering food a few inches around feed holes, or sometimes following rains. They are highly solitary individuals except when mating or when a mother has young, usually fighting to the death if two are put together.

Pocket gophers do not hibernate and, when burrowing under snow, they deposit the excavated earth in abandoned snow tunnels. The earth cores become visible when the snow thaws.

There is one litter per year born in late spring or early summer. Litter size averages 5 or 6 but may range from one to more than a dozen. Dispersal of the young is often done above ground in late summer or early fall. The population turnover rate is often 70-80% per year due to natural causes.

Pocket gophers feed on a great variety of forbs, grasses, seeds, acorns, tubers, bulbs, roots, bark of trees, and when protected by snow, they gnaw on branches and main stems of conifers several feet above ground.

Fir Engraver

The fir engraver, Scolytus ventralis, attacks most true firs in western North America. Attacts can result in mortality, top-kill, or patch kill along the bole in firs ranging from large saplings to old-growth. Mortality and top-kill frequently are associated with stress induced by overstocking, drought, root disease, soil compaction, excessive and sudden exposure, heavy dwarf mistletoe infections, and other factors limiting tree health and vigor. Because of the sporadic occurrence of widespread, severe mortality and top-kill and the prevalence of healthy broods in living trees (patch attacks), direct control measures are generally impractical. A healthy, vigorously growing stand is the best means of minimizing damage from fir engravers.

Adults fly and attack trees or green fir slash between June and September; larvae, pupae, and adults overwinter under the bark of infested trees. The life cycle takes one year, rarely two. Pitch tubes are not formed as with pine bark beetles, but attacks often are characterized by boring dust in bark crevices along the trunk and pitch streamers on the mid- and upper-bole. Trees successfully attacked early in the summer may exhibit fading of the foliage by early fall, but those attacked later in the year will not begin to fade until the following spring or summer. The beetles may have emerged by the time the tree fades.

Several other species of Scolytus, along with Pseudohylesinus, may be associated with the fir engraver. These contribute to the damage, as does the roundheaded fir borer, Tetropium abietis, which is also a frequent associate.

DARDANELLE CAMPGROUND
KEY TO PEST AND HAZARD TREE LOCATIONS ON MAP

1. Two Jeffrey pines with prunable dwarf mistletoe brooms.

2. Dead incense-cedar at restroom; hazardous.

3. Three overstory Jeffrey pines with prunable dwarf mistletoe brooms.

4. Overstory Jeffrey pines with prunable dwarf mistletoe brooms.

5. a) Evidence of gopher activity.
   b) Past white fir mortality (stumps), but no annosus found.
   c) Overstory Jeffrey pine with dead broomed branches over restroom.

6. Overstory white fir with dead spiked top; hazardous.

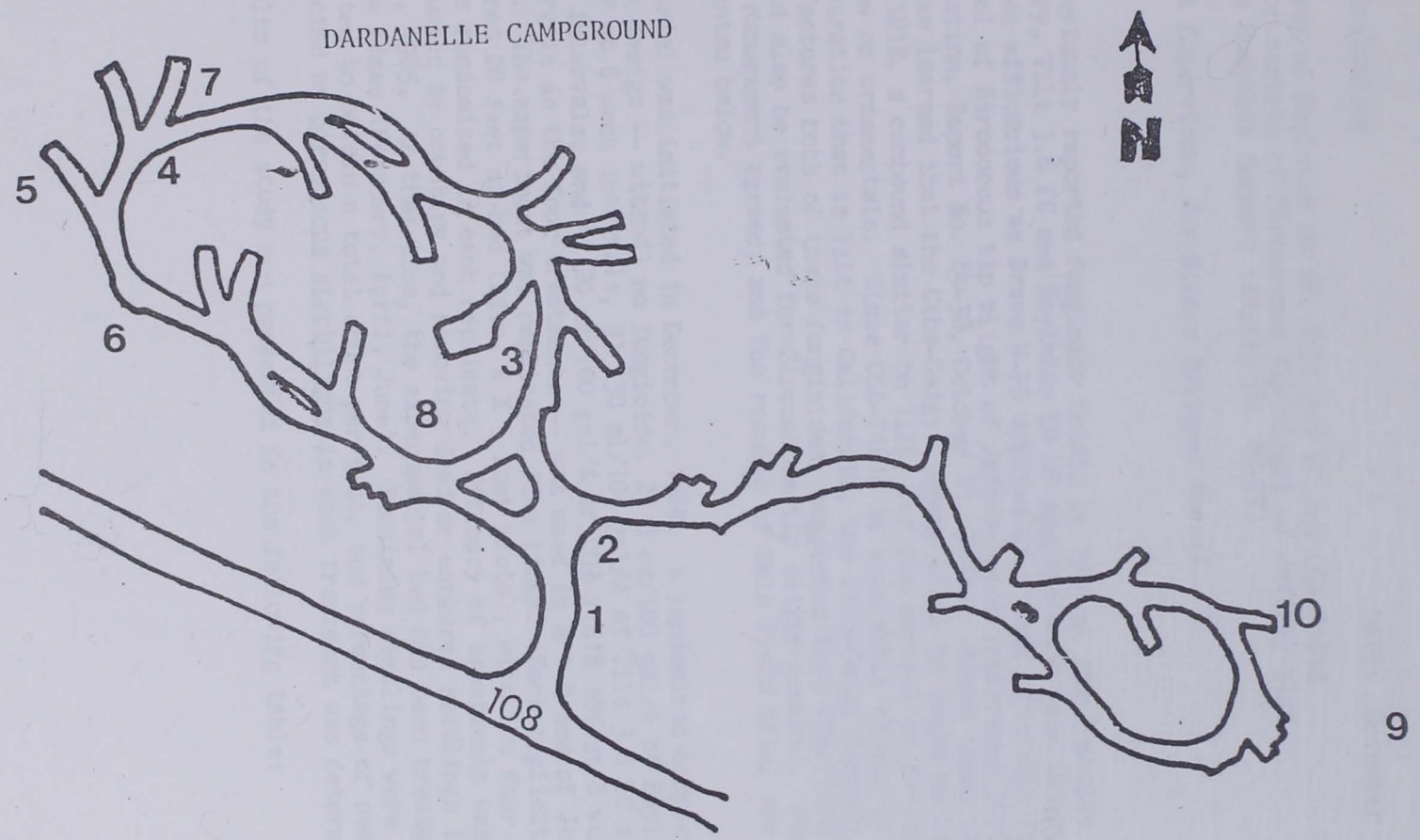
7. White firs with fir engraver attacks, wetwood, frost cracks, scaring from campers; potentially hazardous.

8. Fomes annosus conks in white fir stump.

9. a) Overstory Jeffrey pines with prunable dwarf mistletoe brooms.
   b) Some overstory white fir with dead tops and evidence of wetwood.

10. Dead white firs with past fir engraver attack.

DARDANELLE CAMPGROUND



(Figure 1)